ABSTRACT

The Sensitivity of Simulated Ocean Biogeochemistry to Forcing Fields Derived from NCEP and MERRA Reanalysis Products

Ocean biogeochemistry models are typically forced by atmospheric and oceanic data derived from reanalysis products. For the NASA Ocean Biogeochemistry Model (NOBM) such reanalysis forcing fields include: surface wind stress, sea surface temperature, ice distributions, shortwave radiation, surface wind speeds and surface atmospheric pressure. Additionally, proper computation of ocean irradiance requires reanalysis products of relative humidity and precipitable water (in addition to aerosol and cloud information which is derived from satellite data). The question posed here is, does the choice of reanalysis products make a difference in the representation of ocean biology and biogeochemistry?

NOBM was forced by NCEP and MERRA reanalysis products for the period 2002-2009. We find that in 2009 global distributions and abundances of biological variables (total chlorophyll and nutrients) and carbon (dissolved inorganic and organic carbon and surface pCO2) were similar between the two different forcing fields. Global statistical comparisons with satellite and in situ data also showed negligible differences.

There were, however, substantial regional differences in ocean biology. The Equatorial Pacific, in particular, showed a 52% increase in nitrate using MERRA forcing over NCEP forcing, which led to a 17% increase in total chlorophyll and a 16% increase in primary production. A larger increase in Equatorial Atlantic nitrate of 104% was also observed, which produced a 13% increase in chlorophyll and an 11% increase in primary production. In both cases SST from the reanalysis products was similar but the zonal component of the surface wind stress was more vigorous leading to increased upwelling of nutrients. The results suggested that global biology and carbon processes are relatively unaffected by choice of reanalysis products between NCEP and MERRA, but there can be important regional differences.

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